Professional Development for Environmental Literacy: Investigating Pre-Service Teachers' Perceived Readiness Towards Integrating the Maryland Environmental Literacy Standards into their Practices

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Abstract

Current global environmental problems, such as climate change, require that Maryland educators and students become environmentally literate in order to gain the skills and knowledge needed to make informed decisions and enact powerful environmental solutions. In order to achieve this goal, the Maryland Environmental Literacy Standards were created. However, these standards are not fully implemented within Maryland schools because Maryland educators are both unaware of these standards and have received little effective professional development about the implementation of these standards within their classrooms. This paper discusses the *2014 Teaching for Environmental Literacy Standards* workshop. This workshop exposed senior level pre-service teachers enrolled in the elementary education program in the University of Maryland's College of Education, to the Maryland Environmental Literacy Standards as well as environmental issues affecting the Chesapeake Bay Watershed. An action research study within this workshop evaluated the influence a two-day workshop has on pre-service teachers' perceived readiness to incorporate the Maryland Environmental Literacy Standards and environmental issues into their classrooms. Results showed that the workshop did significantly increase the pre-service teachers' comfort level with the standards and their intention to implement them within their classroom. However, post workshop interviews revealed a gap between comfort level/ intent to implement and actual implementation once the pre-service teachers actually entered their internship classrooms. This study has implications for the creation of future effective professional development programs based on these standards and the topic of environmental literacy.

Introduction

We currently face a global condition with the reality of large-scale environmental problems including global climate change, sea level rise, human overpopulation, mass species extinction, and ocean warming and acidification, all of which can be contributed to human actions. Environmental education is a significant and powerful tool that can be used to address these urgent planetary issues.

Environmental education is a powerful defense against global environmental problems because environmental education is far-reaching and environmental educators work in a variety of settings (Saribas, 2013). The definition and overall goals of environmental education are constantly being redefined but an overall widely accepted goal statement was created during the 1976 UN Belgrade Charter. This charter states:

> *The goal of environmental educations is to develop a world population that is aware of and concerned about, the environment and its associated problems, and which ahs the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones. (UNESCO- UNEP, 1977). "*

Two years after the Belgrade Charter, the Tbilisi Declaration was adopted. This declaration built upon and further established three broad goals for environmental education:

1. To foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas.
2. To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment.

3. To create new patterns of behavior of individuals, groups, and society as a whole toward the environment.

(Guidelines for the Preparations and Professional Development of Environment Educators, 2010)

In more recent years, the goals of environmental education outlined within these two documents have been reevaluated to fit within a new age of environmental urgency as well as a new age when younger generations are less connected with their surrounding environment. As Richard Louv stated in his book *Last Child in the Woods*:

> *Within the space of a few decades, the way children understand and experience nature has radically changed. Today, kids are aware of the global threats to the environment- but their physical contact, their intimacy with nature, is fading. (Louv, 2005, p. 1).*"

With this has come a new focus on the topic of *environmental literacy*, which is an important component in the creation of a world population equipped with the intellectual and social skills to tackle environmental issues and make informed decisions for strong solutions. This topic of environmental literacy had also recently become a key principle within environmental education reform in the state of Maryland.

In 2007, the Maryland Department of Natural Resources and the Maryland State Department of Education collaborated to create the Maryland Partnership for Children in Nature. The vision of this Partnership is to reconnect Maryland communities and students to their environment through creating more green spaces, stronger environmental education in Maryland and engaging communities in the implementation of environmental action plans (Maryland Partnership for Children in Nature, 2009). It is the hope of this partnership that Maryland students will become adequately prepared to "take active roles in addressing the complex environmental challenges facing our world and…

(have) a sense of responsibility for and stewardship of the open spaces, waterways, and natural resources…(Maryland Partnership for Children in Nature, 2009).” In order to achieve this goal, the partnership has adopted its own definition of environmental literacy, which will be the main definition for environmental literacy used within this paper:

> *Environmentally literate students…possess the knowledge, intellectual skills, attitudes, experiences, and motivation to make and act upon responsible environmental decision as individuals and as members of the community. Environmentally literate students understand environmental and physical processes and systems, including human systems. They are able to analyze global, social, cultural, political, physical, economic, and environmental relationships, and weigh various sides of environmental issues to make responsible decisions as individuals and as members of their community and citizens of the world.* (Maryland Partnership for Children in Nature, 2009, p. 12)

To promote environmental literacy among Maryland students, the partnership created and urged the adoption of the Maryland State Environmental Literacy Standards. These standards are based on national standards including the National Science Education Standards, North American Association for Environmental Education Standards, and the National Council of Social Studies Standards. These standards represent the knowledge and skills relating to environmental literacy the students should obtain before graduating from the Maryland school system and are meant to be, emulating the very nature of environmental education, interdisciplinary and used to enhance existing courses (Maryland Partnership for Children in Nature, 2009). The

Maryland Environmental Literacy Standards are a pivotal focus of this paper and the study described within it.

The Maryland Environmental Literacy Standards consist of 8 standards:

Standard 1: Environmental Issues
Standard 2: Interactions of Earth's Systems
Standard 3: Flow of Matter and Energy
Standard 4: Populations, Communities, and Ecosystems
Standard 5: Humans and Natural Resources
Standard 6: Environment and Health
Standard 7: Environment and Society
Standard 8: Sustainability

Within these standards are a comprehensive set of skills and knowledge that Maryland students should possess by the time they graduate high school. However, implementation of these standards within any given classroom within a Maryland school is rare. This is due to the fact that few Maryland teachers know about these standards or have received professional development based on these standards. In an effort to create better awareness of these standards, the Partnership for Children in Nature Higher Education Sub-Committee (chaired by Ms. Laurie Jenkins), partnered with the College of Education and the Office of Sustainability at the University of Maryland in an initiative to expose the College of Education elementary program pre-service teachers to these standards. As an academic advisee of a committee member (Dr. J. Randy McGinnis, Department of Teaching and Learning, Policy and Leadership, College of Education, UMD), I was given the task to create a workshop that would educate UMD pre-service teachers about the Maryland Environmental Literacy Standards as well as locally relevant environmental issues. The vision of this workshop was to inspire implementation of these standards and environmental topics within the pre-service teachers year-long internship. This workshop also acted as a platform for a research study. The purpose of this research

study was to decipher how a short-term (two-day) workshop would influence or change pre-service teachers' perceived readiness to incorporate the Maryland Environmental Literacy Standards into their internship classrooms. Both the workshop and the study will be described in depth later in later sections.

Literature Review

Within this section, I will conduct a literature review on documents discussing effective environmental education professional development, current educator perceived barriers to implementing effective environmental education, environmental literacy levels among current students and educators, and effective classroom implementation of locally relevant environmental topics.

The North American Association for Environmental Education (NAAEE) is a respected association linking professionals, students, and education volunteers who are dedicated to working to improve the field of environmental education through North America as well as other countries all over the world. In 2000, the NAAEE accessed assess members of the environmental education community in order to assess their beliefs about how people become environmentally literate and concerned citizens. In partnership with the United States Environmental Protection Agency, this information was used to create a coherent document entitled, *Guidelines for the Preparation and Professional Development of Environmental Education* (Guidelines for the Preparation and Professional Development of Environmental Educators, 2010). This document was part of a series of documents published by the NAAEE, as part of the National Project for Excellence in Environment Education (Guidelines for the Preparation and Professional Development of Environmental Educators, 2010).

The purpose of the *Guidelines for the Preparation and Professional Development of Environmental Educators* document is to provide a synthesized set of recommendations of the "basic knowledge and abilities educators need to provide high- quality environmental education" (Guidelines for the Preparation and Professional Development of Environmental Educators, 2010, 2). The guidelines are meant for multiple contexts including pre-service teacher educator programs, PD programs for teachers of both formal and informal educational settings, and full-time environmental educators. The guidelines are centered on a focus of providing guidance for experiences and learning that will effectively foster *environmental literacy* among both educators and their prospective students. These guidelines stem from input from the NAAEE community while also aligning with the goals of environmental education outlined in the Belgrade Charter and the Tbilisi Declaration (which were previously discussed in the introduction section of this paper).

The guidelines are divided into six themes all accompanied by supporting materials to aid in promoting competency in environmental education (Guidelines for the Preparation and Professional Development of Environmental Educators, 2010):

- Theme one: Environmental Literacy
- Theme two: Foundations of Environmental Education
- Theme three: Professional Responsibilities of the Environmental Educator
- Theme four: Planning and Implementing Environmental Education Programs
- Theme five: Fostering Learning
- Theme six: Assessment and Evaluation

Theme one focuses on the idea of obtaining environmental literacy as an environmental educator or educator intending to incorporate environmental themes and topics into their classrooms. This *NAAEE Guidelines* theme was particularly pertinent to the design of my summer workshop. According to the *Guidelines*, being environmentally

literate requires the acquisition of specific knowledge and various skills. The first being the ability to “ask questions about the surrounding world, speculate and hypothesize, seek and evaluate information, and develop answers to question (Guidelines for the Preparation and Professional Development of Environmental Educators, 2010, 8).” Essentially, being environmentally literate requires a familiarity with basic levels of inquiry. It also requires basic knowledge of different environmental systems and human influences on them. Within understanding human influences on environmental systems, being environmentally literate requires the ability to “learn, evaluate, and act on environmental issues (Guidelines for the Preparation and Professional Development of Environmental Educators, 2010). Finally, being environmentally literate suggests a level of commitment on the part of the individual to form conclusions and then act on them in order to enhance environmental quality.

Theme one is the one that pertains most directly to the creation of the workshop and study described within this paper. The other themes however, were important as well. Theme two discussed the based goals, practice and history of the environmental education field. Theme three discusses the responsibilities associated with delivering high quality environmental education. Theme four discusses implementing interdisciplinary, hands on, investigative learning opportunities for high quality environmental education. Theme five outlines tactics to creating a learning climate that is conducive to discussing and learning about environmental issues, especially those deemed “controversial. Finally, theme six discusses various aspects of the assessment and evaluation side of environmental education.

The NAAEE *Guidelines for the Preparation and Professional Development of Environmental Educators* strongly influenced another piece of literature present in this literature review. The NAAEE *Guidelines for the Preparation and Professional Development of Environmental Educators* influenced the 2000 *Best Practices for Environmental Education: Guidelines for Success*. This document was a project of the Ohio EE 2000: A strategic Plan for Environmental Education in Ohio. The purpose of this plan was to outline "a strategy for building Ohio's ability to promote reform-based environmental education that is interdisciplinary, community based, and learner-centered. (Meredith, 2000)." Though this plan was made specifically for Ohio education reform, the practices outlined within it can be translated nationwide.

Just like the NAAEE *Guidelines*, the Ohio EE *Best Practices* is centered on the idea of helping learners become environmentally literate citizens. This document was meant to be used within the creation of a wide variety of EE programs both formal and non- formal. The first chapter gives an overview of what environmental education is as a discipline: "Environmental education is education in, about, and for the environment. (Meredith, 2000)." It also talks about different aspects of environmental education such as the educational settings, learners and time frames for learners. These characteristics parallel with other educational subjects but the overall point of this chapter is that EE takes place within a wide variety of educational settings and should be accessible to all types of learners.

The second chapter discusses the knowledge, skills, attitudes, and behaviors that are the focus within EE programs.

- **Knowledge** emphasizes conceptual understanding of subject matter.
- **Skills** include a full range of processes and abilities, higher level thinking, and communication skills that encourage lifelong learning.
- **Attitudes and values** involve analysis and clarification of individual and group attitudes and values, rather than the acceptance of a particular set of attitudes and values.

- **Behavior** refers to individual and collective actions that contribute to healthy and sustainable living in a global community, linking today's actions with future consequences. It includes an emphasis on the strategies that lead to responsible behavior and global stewardship.
  (Meredith, 2000)

This chapter provides content outlines K-12, higher education, as well as adult and general public learners. The content guidelines present within this paper are correlated with the four strands outlined within the NAAEE *Guidelines* (Questioning and Analysis skills, Knowledge of Environmental Process and Systems, Skills for Understanding and Addressing Environmental Issues, Personal and Civic Responsibility), which I have already described above. These strands were used because they describe environmental education as more than consumption of factual knowledge or technical information. Instead, environmental education promotes lifelong learning, skills, and activism. In terms of EE for adults and general public learners, environmental literacy should be a goal for all citizens. Within this chapter, the authors refer to Roth et al, 1992 to describe a continuum of environmental literacy that can persist throughout a person's entire life. Along the continuum are *nominal*, *functional*, and *operational* levels of environmental literacy, each of which is a more sophisticated level of literacy than the level before it. See table 1 below for a description of each level.

Nominal Learners who have achieve this level:	Functional	Operational
Recognize basic terms in communicating about the environment and can provide rough definitions of their meanings.	Possess a broader knowledge and understanding of interactions between human social systems and natural systems.	Have moved beyond functional literacy in the breadth and depth of understanding and skills.
Possess awareness and sensitivity towards the environment, respect for natural systems, and concern for nature and human impacts on the environment.	Are aware of and concerned about negative interactions between human and natural systems in terms of one or more issues.	Routinely evaluate impacts and consequences of actions.

Have rudimentary knowledge of natural systems and how the human social systems interact with them.	Can analyze, synthesize, and evaluate information about issues using primary and secondary sources.	Gather and synthesize pertinent information, choose among alternatives, and advocate positions and actions that work to sustain or enhance a healthy environment.
	Communicate findings and feelings to others.	Demonstrate a strong, ongoing sense of investment in and responsibility for preventing or remediating environmental degradation
	Demonstrate a motivation to work toward solutions to environmental problems by using basic strategies for social or technological change.	Act at several levels, from local to global, and routinely engage in dealing with the world at large.

Table 1. Roth (1992) Levels along the environmental literacy continuum.

The third chapter discusses environmental education program development and implementation. One particularly pertinent part of this chapter to the study and workshop later described in this paper, is the discussion of the interdisciplinary nature of environmental education and how it can be delivered in an interdisciplinary, integrated manner. According to the authors, an integrated approach to teaching environmental topics can take three forms; multidisciplinary, interdisciplinary, transdisciplinary.

- **Multidisciplinary**: To emphasize a single idea and explore how concepts, principles, or topics from various disciplines exemplify the theme.
- **Interdisciplinary**: To investigate an issue or topics through thematic idea. It integrates disciplines of study and allows learners to make connections to real0life issues that are relevant to them.
- **Transdisciplinary**: To investigate broad areas of interest that exemplifies a theme. Drawing upon a mix of disciplines appropriate to studying a theme.

(Meredith, 2000, p. 26)

This chapter also provides guidelines specifically for the design of a workshop. These guidelines include advice on how to engage participants, the types of non-traditional learning experiences that can be included, as well as how to effectively use media products.

Chapter four discusses evaluation and assessment of environmental education programs. The guidelines for evaluation are appropriate for a workshop type setting. There are many different methods of evaluation from interviews to questionnaires to observation notes. Evaluation can be used to determine how well the program has achieved stated goals and objectives. Evaluations can be helpful in gauging whether the program reached the intended audience, whether this audience understood and retained the content material, and can even go a step further in determining whether this content changed learners' opinions, attitudes, or behaviors.

Finally, chapter five outlines professional development program guidelines for pre-service teachers. The guidelines align with the six themes of the NAAEE *Guidelines for the Preparation and Professional Development of Environmental Educators* so they do not need to be restated.

Parlo and Butler (2007) report findings from a coastal marine environmental education workshop designed for in-service teachers. Within this study, teachers participated in a 15-day residential professional development program called Rivers to Reefs/Coastlines (R2R) held at the University of Georgia Marine Education Center. The study investigated the effects of the workshop on the participants' infusion of environmental topics into their classroom curriculum (Parlo and Butler, 2007). The two research questions with this study are:

- *In what ways are past participants of R2R integrating environmental topics covered in the program into their instruction?*
- *What limitations or barriers are perceived to hinder the integration of environmental topics in their curriculum?*

The researchers conducted qualitative interviews. The participants were asked to discuss activities from the workshop that they were utilizing within their classrooms as

well as any obstacles they encountered when trying to implement those activities. Three main barriers to implementation emerged within the interviews.

The first barrier was the teachers' concern with rigorously following the established school and state standards. The majority of the teachers reported concern about following standards in order to adequately prepare their students for high stakes state tests. The participants reported that prepping their students for these tests demands a lot of time, which does not allow for addition of instructional material from the workshop. The second barrier revolved around the ability of the teacher participants to translate the R2R content into the classroom in a way that was meaningful for their students. During the workshop, the participants are allotted time to collaboratively create activities based on experiences and content learned from the program. Despite this opportunity, "teachers reported only using heir generated activities if it directly reflected one of the science standards for their content (Parlo and Butler, 2007, 34)." Many teachers also reported that they struggled to tie the information they learned in the program into their classroom because they did not teach on the coast. The third and final barrier was the participants' perceived difficulty to teach environmental topics within a traditional classroom setting. They frequently cited problems such as lack of funding for field trips indicating that they did not believe they could teach the content of the program within their formal classroom setting.

Parlo and Butler conclude that effective environmental education professional development is needed and necessary. They suggest that greater emphasis need to be given to providing clear and tangible links from PD content and activities to classroom practice within EE professional development. The impact of this study is that it further

contributes to a broader understanding of effective professional development design and teacher instruction.

Another study that focused on post workshop implementation barriers was a study conducted by Zint and colleagues in 2002. Zint et al. assessed a various conservation education programs conducted by the Chesapeake Bay Foundation. The study sought to assess the various conservation education programs' abilities to "promote participants' environmentally responsible behavior (ERB) and reduce teachers' perceived barriers to teaching about the bay (Zint et al., 2002, 641)." The ERB characteristics that Zint and colleagues measured were environmental sensitivity, knowledge of ecology, knowledge of issues, personal responsibility, knowledge of actions, skill in actions, locus of control, intention to act (Zint, 2002).

Zint et al. found that each of the ERB characteristics in youth participants were affected by at least one of the five CBF programs in their study. They found that the duration of a program effected the ERB characteristics in different ways. For example, they found that participants in the 2-week long field trip programs scored higher in knowledge of issues, knowledge of actions, skills in actions and intention to act than those participants in shorter duration programs. Participants in the field trip programs (regardless of field trip duration; two-weeks, three days, 1 day) scored higher than participants in the curriculum program in all ERB categories.

Zint et al. also assessed teachers' perceived barriers to teaching about environmental topics within their classrooms after participating in a CBF curriculum workshop. Zint found that after the workshop, teachers self-reported having improved in all ERB characteristics and also rated themselves high in each ERB category. 70% of

participants also reported having changed their actions in terms of Bay protection after the workshop (Zint, 2002). Before the workshop, teachers reported implementation barriers like financial resource, preparation time, classroom time, access to field trips, flexibility in curriculum, science knowledge, etc. After participating in a curriculum workshop through CBF, all participants reported a decrease in perceived barriers.

Through these findings, Zint et al. concluded that the CBF conservation programs have the potential to promote environmentally responsible behavior both for young students and educators. They also concluded that programs promoting environmental education integration are more effective when multiple experiences are provided and when the programs extended over a long period of time than a one-day session. Also, in targeting specific ERB characteristics for the participants, a given environmental education program can be more effective and a productive tool for promoting lifelong changes in behavior that protects the Bay.

Shepardson et al. (2007) believe that one particularly important environmental topic that should be presented to young learners is the *watershed concept* (Shepardson, 2007). In understanding the watershed, Shepardson and colleagues believe that students will also gain a better understanding of other environmental issues and topics such as water quality, land use practices and changes, pollution, and human impact on ecosystems. It is their hope that if young learners understand the watershed concept and issues within their own watershed, they will become informed citizens that make effective resource management decisions. This study took place with 915 students across multiple grade levels (elementary, middle, and high school) in multiple school and

community settings (urban, suburban, rural). This study investigated students' conceptions of a watershed and focused on two research questions:

- What are students' conceptions of a watershed?
- In what ways might students' conceptions vary by grade level and community setting?

Shepardson et al. found that students' conceptions of watersheds fell into four categories.

- *Conception1: Watershed as a natural and dynamic process consisting of a developed hydrological cycle.*
- *Conception 2: Watershed as a natural process containing elements of the hydrological cycle.*
- *Conception 3: Watershed as the natural storage of water.*
- *Conception 4: Watershed as a human- built facility for storing water.*

(Shepardson, 2007, 560)

Shepardson et al. found that students' conceptions of a watershed varied by grade level and community setting. Some findings were as follows. A greater percentage of upper elementary and middle school students adhered to conception one compared to the percentage of high school students. Rural students were more likely to have a more sophisticated understanding of a watershed and its part in the hydrological cycle compared to suburban and urban students. Urban students were more likely to represent the word "watershed" as a literal shed of water than rural and suburban students. Conception 3 was also more likely to be held by rural than urban and suburban students. One of the more cohesive findings is that the majority of students conceptualized a watershed as an "area of land with high relief and elevation where water is cycled, stored or transported (Shepardson, 2007, 576)."

Overall, the majority of students did not display an understanding that they, along with all humans, are an integral part of a watershed or that humans have the ability to

impact a watershed and water quality. Many students also have a misunderstanding of what a watershed is or its function. The authors of this study believe that the watershed topic is locally relevant and a topic that can be integrated within a classroom interdisciplinarily. The authors suggest concepts that should be further developed in order to improve students' understanding of a watershed. The authors also suggest further studies on students' conceptions of a watershed and how they connect with their environmental behaviors and decision-making.

Tuncer et al. (2009) assessed pre-service teachers' environmental literacy as a means of evaluating the relationship between pre-service teachers' knowledge, attitude, concerns, and interests in environment problems. The authors believe that our current global condition insists that educational systems include environment education and that it is imperative to create an environmentally literate citizenry that can work to make informed decisions to solve environmental problems (Tuncer, 2009). In assessing the level of environmental literacy of pre-service teaches, the authors focus on four elements; knowledge, skills, affect, and behavior. They also define environmental literacy as a function of "an individuals' increased sensitivity, knowledge, skills, attitudes, and values towards the environment (Tuncer, 2009, 427)." The study focused on four research questions:

- What is the environmental literacy level of pre-service teachers?
- What are the relationships between components of environmental literacy such as environmental knowledge, attitudes, use, and concerns for pre-service teachers?
- What is the relationship between environmental backgrounds of pre-service teachers and their environmental literacy?
- What is the effect of gender on the environmental literacy of pre-service teachers?

(Tuncer, 2009, 428)

Tuncer and colleagues found that, in spite of overall low levels of environmental knowledge, the pre-service teachers within their study expressed both a high level of concern for the environment as well as very positive feelings towards the environment. The teacher participants also expressed feeling responsible for multiple environmental problems. Tuncer also found that as pre-service teachers' interest in environmental knowledge, environmental knowledge and concern are linked. As their interest increases so does their knowledge and concern (and vice-versa). They found that individual pre-service teachers that show more concerned about environmental problems tend to have more positive attitudes towards the environment and sufficient environmental knowledge. The most interesting finding of the study is that female pre-service teachers were found to overall more positive attitudes and exemplify more responsible actions toward the environment than male pre-service teachers.

The findings of this study can be used to help create better teacher education programs; programs which emphasize environmental education and important environmental issues. This can help create environmentally literate teachers, which will help create the next generation of environmentally literate students and citizens.

Saribas et al. (2014) used findings within the Tuncer study to investigate the link between pre-service elementary teachers' environmental literacy and self-efficacy beliefs in a teacher education program in Turkey. The focused on the following research questions:

- What is the pre-service elementary teachers' environmental literacy level?
- What is the level of pre-service elementary teachers' self-efficacy related to environmental literacy components (those outlined in Tuncer: knowledge, attitude, behavior, concern)?
- Is there any significant relationship between environmental literacy and self-efficacy beliefs toward environmental education?

The pre-service teaches within this study all had concentrations in elementary education studies and had little or no background in science (Saribas, 2014). Saribas and colleagues found a small but significant relationship between self efficacy beliefs related to environmental concern; the more the pre-service teachers showed concern about environmental problems, the stronger their self-efficacy to teach about those problems. Overall, there was no significant correlation found between self-efficacy beliefs and environmental knowledge, attitude, or behavior (Saribas, 2014). Saribas and colleagues concluded the study by saying that the pre-service teachers' self- efficacy beliefs can be enhanced in conjunction with their concern for environmental problems (Saribas, 2014). This will then contribute to their effectiveness in helping their students become environmentally literate citizens. This study provides further information that can be helpful in creating stronger environmental education professional development programs as well as programs that support the integration of environmental content within pre-service teacher education programs.

Another study that focuses on the topic of environmental literacy is one conducted by William McBeth and Trudi Volk (2010). Instead of looking and environmental literacy levels of pre-service teachers, McBeth and Volk focused on creating a baseline measure of environmental literacy among middle school students in the United States. Through this study, McBeth and Volk aimed at providing "the environmental education community with its first ever glimpse of the level of environmental literacy across the United States at the middle school level (McBeth and Volk, 2010, 56)." They hoped to provide insight on what young middle school students think, feel, and know about the environment and current environmental issues.

The sample within this study was a nationally stratified random sample of sixth and eighth graders. This study was conducted with two research focuses: the level of environmental literacy of sixth and eighth grade students across the U.S. on specific environmental literacy variables (namely ecological knowledge, verbal commitment, actual commitment, environmental sensitivity, general environmental feelings, and environmental issue and action skills), and the general level of environmental literacy of sixth and eighth grade students across the U.S.

In terms of the first research focus, McBeth and Volk discovered the following:

- In general, eighth grade students tended to outscore (though only slightly) sixth grade students on measures of knowledge and cognitive skills. (McBeth and Volk, 2010)
- Sixth graders tended to outscore eighth graders on affectively oriented sensitivity and environmental feelings measures. They also tended to exhibit more action oriented intentions and behaviors. (McBeth and Volk, 2010)

In terms of the second research focus which sought to identify a more general level of environmental literacy among sixth and eighth graders, McBeth and Volk that overall both sixth and eighth graders scored highest in measures of ecological knowledge and lowest in cognitive skills measures (compared to the other measure of environmental literacy listed above). McBeth and Volk observed that, overall, their study sample of sixth and eighth graders possessed a moderate level of ecological understandings while also exhibiting moderately positive attitudes toward the environment. However, the main differences between the age groups were that the older students possessed cognitive knowledge and skills than the younger students but the younger students demonstrated a

greater willingness to take positive actions and participate in pro-environmental behaviors (McBeth and Volk, 2010). Finally, both sixth and eighth grade students demonstrated an underdeveloped ability to think critically and make decision to resolve tough environmental issues (McBeth and Volk, 2010).

As with the other studies already discussed within this literature review, McBeth and Volk feel that the findings in this study are important in promoting the creation of environmental education programs that effectively create an environmentally literate citizenry. This study provides a baseline measurement of environmental literacy among U.S. middle schools and establishes areas of need within the advancement of environmental literacy for young students.

Implications from Literature Review. The research done within these sources has implications for the field of environmental education as a whole and had a major impact on the design of the workshop and study featured in this paper.

These articles contribute to the enhancement of environmental education professional development programs. The NAAEE *Guidelines for the Preparation and Professional Development of Environmental Educators* and the Ohio Environmental Education *Best Practices 2000* documents provide explicit instructions and advice regarding important aspects of a professional development program such as setting, content, and duration. This advice is validated because it comes from a collaboration of large environmental education communities with the involvement of a variety of stakeholders.

The information in these documents directly influenced the creation of the *2014 Teaching for Environmental Literacy Workshop* described in this paper. Since this was

my first time being involved in the design of a professional development centered workshop, I was able to use these documents to gain a better understanding of what makes a workshop successful. I was also able to gain a better understanding of what it means to be environmental literate as well as a better understanding of how to effectively help the participants in my workshop come away with a more sophisticated sense of their own individual environmental literacy. These document were referred to when the goals of the *2014 Teaching for Environmental Literacy Workshop* were being formed and when the logistics were being planned.

The Parlo and Butler (2007) and Zint et al. (2010) articles provide important insight on educators' perceived barriers to integrating environmental topics into their classrooms. Helping students become environmentally literate is not a simple process. It requires educators to be environmentally literate themselves. In a study done by Disinger and Roth (1992), they define environmental literacy as:

> *Environmental literacy is essentially the capacity to perceive and interpret the relative health of environmental systems and take appropriate action to maintain, restore or improve the health of those systems. (Disinger and Roth, 1992,p.2)*

This is just one of many interpretations environmentally literacy but all definitions emphasize a complex metacognitive process that involves knowledge of environmental systems as well as critical thinking and decision making skills. The Tuncer article, as well as the Saribas article, also describes environmental literacy as being comprised of four elements- knowledge, skills, affect, and behavior (Tuncer, 2009). Since environmental literacy is a difficult skill to achieve it is important to understand all the perceived barriers that are impeding teachers ability to be effective environmental

educators. In understanding institutional, knowledge, and affective limitations teachers face, professional development programs can be designed to show teachers how to integrate environmental topics into their classrooms while eliminating potential barriers.

The participants in the *2014 Teaching for Environmental Literacy Workshop* were pre-service teachers entering their yearlong internship as teaching interns. As teacher interns, they would experience some of the barriers described in the Parlo and Butler (2007) and Zint et al. (2010) article. In reading these articles, I was more prepared to address some of the barriers that the participants would face when trying to translate the material learned within the workshop to their placement classrooms. Understanding their potential barriers made for a more successful workshop.

Finally, the Shepardson et al (2007) article greatly influenced the design of the *2014 Teaching for Environmental Literacy Workshop*. The participants in this workshop live and work in the Chesapeake Bay area. Their students' lives are directly affected by environmental problems in the Chesapeake Bay yet, like the Shepardson article points out, many do not have a well developed understanding of what a watershed is, how it functions, or the ecosystem and societal services it provides. The Shepardson article provided me with the idea of making one of the central themes of the workshop be the Chesapeake Bay. It also provided me insight to the preconceptions the workshop participants and their potential elementary aged students might have about watersheds.

Design and Data Collection

*Design of the Professional Development***:** The *2014 Teaching for Environmental Literacy Workshop* was created collaboratively between the Partnership for Children in Nature Higher Education Sub-Committee (Chaired, by Ms. Laurie Jenkins), The College

of Education at the University of Maryland, and the Office of Sustainability at the University of Maryland. As an advisee of a committee member (Dr. J. Randy McGinnis, Department of Teaching and Learning, Policy and Leadership, College of Education, UMD, who was my academic advisor) I was given the task by him of creating and leading the workshop. My advisor and Mr. Mark Stewart, Office of Sustainability jointly supervised me. Emily Hestness, (doctoral advisee to Dr. J. Randy McGinnis) was also a primary co-collaborator in the design and implementation of this workshop. The overall goal of the workshop was to expose pre-service teachers to the Maryland Environmental Literacy Standards in the hope that they would apply their knowledge of the standards into their classrooms during their yearlong internships. This workshop would act as the platform for a study of how a workshop of this nature changes pre-service teachers' perceived readiness to incorporate the Maryland Environmental Literacy Standards into their internship classrooms.

To ensure that this professional development workshop had membership, I first had to work on recruitment. Much deliberation went into where exactly the participant base for this workshop would be drawn. At first, recruitment was opened up to all disciplines while some recruitment strategies were focused more heavily on education majors. In order to recruit potential participants, flyers were created for the workshop and placed within different buildings on campus with special emphasis on the College of Education, Benjamin Building. A copy of this flyer is located in Appendix I. It was very important that a good base of juniors in the elementary education program signed up in order for the study on perceived readiness to be a success because they would be the participants that would be working within a classroom setting within the next year.

Because of this, an additional recruitment tactic was used in which I visited junior level methods courses and spent a few minutes talking about the workshop and explaining how they could sign up to participate. I believe that this was the most successful recruitment tactic. In the end the participants were thirteen junior pre-service teachers in the elementary education program at the College of Education. This workshop took place the week before these pre-service participants would be entering their placement schools as teacher interns in Montgomery county, Prince George's County, and Anne Arundel County public elementary schools.

The *2014 Teaching for Environmental Literacy Workshop* was designed as a two-day in person workshop with brief online assignments to be completed before each day of the workshop to add to the in-person experience each day. The goals of each day of the workshop were:

- To expose the participants to the Maryland Environmental Literacy Standards.
- To help the participants connect these standards to their classroom curriculum and state curriculum (i.e. Maryland State Standards, Common Core Standards, Next Generation Science Standards).
- To assist them in becoming more environmentally literate educators.
- To help them gain more content knowledge about a specific environmental issue.
- To help them make a connection and work collaboratively with other Maryland pre-service elementary school educators.

Both days of the workshop took place on the University of Maryland Campus. Usually these students spend all of their time within the College of Education's Benjamin building on campus so we chose a different indoor and outdoor location on a different side of campus for the workshop in order to create an exciting experience that did not feel like just another class.

The first day of the workshop revolved around two themes: water quality/ water use in the Chesapeake Bay Watershed, and working from *topic to standard*. The participants worked from topic to standard on this first day by first exploring an environmental issue (water quality and water use in the Chesapeake Watershed) and ways in which it could be incorporated into their classrooms (through activities etc.) prior to connecting that content to the Maryland Environmental Literacy Standards. In doing this, it was the hope of the instructors that the participants would learn about a locally relevant environmental issue and then discover how easily it applies to the Maryland Environmental Literacy Standards. During this first day, the participants explored their initial conceptions of environmental literacy, learned about the Chesapeake Watershed and environmental issues concerning the Bay, observed and created classroom activities incorporating the topic of the Chesapeake Bay Watershed, participated in a stream macroinvertebrates exploration in the Paint Branch stream and collaboratively researched how the issue of climate change will impact the Chesapeake Bay Watershed. Copies of material and activities did on day once can be found in the Appendix.

The second day of the workshop focused on two new themes; air quality/ air pollution in the Chesapeake Bay Watershed, and working from *standard to topic*. During the second day of the workshop, we placed more emphasis on collaboration activities and having the participants dominate the conversation. The participants worked from standard to topic by first looking at a standard (more specifically they focused on standard six and eight) and then dissecting it and collaboratively discussing topics and classroom activities that would fit with those specific standards. Examples of the lesson plans and learning activities created by the participants can be found in Appendix VI.

One of the more overarching goals of workshop was to provide the participants with a higher level of content knowledge about environmental issues as well as the Maryland Environmental Literacy Standards. To adhere to this goal, the instructors had two guest speakers present during the second day. The first guest speaker was Dr. Ross Salawitch, a professor in the University of Maryland Atmospheric and Oceanic Sciences Department. Dr. Salawitch informed the participants about air pollution in the Chesapeake Bay area and how air pollution contributes to the larger problems of global climate change. The second guest speaker was Mark Stewart from the University of Maryland Office of Sustainability. Mr. Stewart informed the participants about how their campus is working to combat environmental issues and become a greener, more sustainable campus. Finally, to make sure the second day was focused more on the participants dominating the conversation, the instructors facilitated two discussions about environmentally sensitive topics. For the first, the participants discussed single use water bottles, their impact on the environment, and the participants' own personal lifestyle habits involving single use items. For the second discussion, the participants researched (in groups) the Keystone XL pipeline. The participants then presented their research to a mock group of congressmen and women (the workshop facilitators) urging them to either approve or reject the Keystone XL Pipeline. The participants then discussed this issue further as a whole group.

At the end of the workshop, the participants received a Certificate of Proficiency in the Maryland Environmental Literacy Standards.

*Data***.** I used the PD workshop as a vehicle to study how an environmental literacy specific workshop affects pre-service teachers' perceived readiness towards integrating

content specifically addressing the Maryland Environmental Literacy Standards into their classroom practices and curriculum. My study aims to provide insight into the challenges and benefits participants perceived related to integrating environmentally important topics into their classroom curriculum. See Appendix IX for a copy of my approved IRB proposal. At the beginning of the first day, the participants were informed about the study and were provided consent forms. Out of thirteen participants, twelve agreed to participate in the study and nine agreed to be interviewed at a time after the workshop for further data collection. Various pieces of work completed by the participants during the workshop were collected for data analysis:

- Opening drawing: Your Vision of a Sustainable Future
- Pre and post workshop questionnaires
- Environmental literacy interpretation posters (pre and post workshop)
- Interdisciplinary learning activities
- Post workshop interviews (3 participants)

Opening drawing: Your Vision of a Sustainable Future

At the very beginning of the first day of the workshop, the participants were asked to draw a picture response to the following prompt:

Your vision of a sustainable future: In the space below, draw a picture that captures what you want the future to look like. One the back of the sheet, write down what you intended to communicate in your drawing.

Four themes emerged within these drawings: Positive depictions of nature, renewable energy/ alternative modes of energy, waste reduction, and alternative modes of transportation.

1. *Positive depictions of nature:* Eleven out of twelve of the participants included trees in their picture and explicitly wrote about trees within their written explanation of their drawings. They used words indicating that a sustainable future includes a lot of trees. They also used phrases like, “no

deforestation", "trees needed for oxygen", "gives fresh air", to indicate the benefits of trees. Other positive depictions of nature included drawings of healthy wildlife, drawings of clean and blue bodies of water, and drawings of gardens, the sun, and flowers.

2. *Renewable energy/ alternative modes of energy:* Ten out of twelve of the participants included solar panels or wind turbines in their drawings. Two of the participants explicitly wrote "alternative forms of energy" in their written explanation.
3. *Waste reduction:* Throughout all of the drawings, there were indicators of waste reduction. Six participants indicated a reduction of water waste in their drawings. They did this through drawings of rain barrels, rain water being diverted to gardens, and drawings of people turning off faucets. There were also details indicating a reduction in trash waste. Eight of the participants included drawings of the recycling symbol or of a recycling bin. One participant also drew a picture of a reusable water bottle indicating a reduction in both trash and water waste. Other drawings included examples of other waste reduction tactics such as upclycing: one participant drew a house made out of water bottles.
4. *Cleaner modes of transportation:* Six of the participants drew and wrote about using a bike as a cleaner mode of transportation. Four other participants included drawings of public transportation, cars that use other forms of energy besides gas, carpooling, or more fuel-efficient vehicles.

These four themes demonstrate that the participants of the *2014 Teaching for Environmental Literacy Workshop* entered the workshop with some prior knowledge of the topic of sustainability and current popular societal methods of being more sustainable. These drawings also indicate that the participants came into the workshop with many similar notions of both infrastructure and behavioral changes that can be made for a more sustainable future. Examples of these drawings can be found in the Appendix II.

Environmental Literacy Interpretation Posters

The definition used for environmental literacy used within this study comes from the Partnership for Children in Nature:

> *Students that possess the knowledge, intellectual skills, attitudes, experiences, and motivation to make and act upon responsible environmental decisions as individuals and as members of their community. Environmentally literate students understand environmental and physical processes and systems, including human systems. They are able to analyze global, social, cultural, political, physical, economic, and environmental relationships, and weigh various sides of environmental issues to make responsible decisions as individuals and as members of their community and citizens of the world. (*Maryland Partnership for Children in Nature, 2009, p. 12)

At both the beginning and the end of the workshop, the participants were asked to work in groups and created posters portraying what it means to be an environmentally literate student and an environmentally literate teacher. Within both the pre and post workshop posters, there is evidence of parts of the Partnership for Children in Nature definition as well as Tuncer et al.'s (2009) four elements of environmental literacy (knowledge, skills, affect, behavior). In the pre-workshop posters, there is a great emphasis on *behavior*. Each of the posters either have drawings or words indicating environmentally responsible behavior such as walking or biking to school, recycling, and turning off the faucet to save water. While the drawings indicate that these are behaviors

environmentally literate individuals take part in, all of the posters hold educators to a higher standard of not only participating in these actions themselves but incorporating these practices into their classrooms and leading by example. For example, one of the posters states, “As a teacher, incorporate energy-saving practices into class procedures, rules, and routines.” Two of the groups also seem to believe that environmental literacy is something taught/ learned outdoors; they drew young students learning under a tree and one group wrote, “Get the students outside!” The teaching portrayed in all the posters but one is still portrayed as teacher oriented. In terms of knowledge and skills, one group explicitly wrote that being an environmentally literate teacher meant having the responsibility to understand environmental issues and solutions to those issues while students should be able to comprehend the consequences of their actions while seeking solutions. Another group drew a picture of thermometers and wrote “global warming” underneath alluding to some level of knowledge of the issues but did not designate whether it was for the students or the teachers. Finally, one last pattern that is evident among the posters is the indication of environmental literacy as connected to literacy in terms of reading. Two of the groups drew books or wrote about “read about it.” This is obviously stemming from a literal translation of the word “literacy”.

Within the post-workshop posters, it becomes evident that the participants have become more comfortable with being an environmentally literate educator as the drawings and writing on the posters becomes much more teacher- oriented. For example, every poster includes the word “interdisciplinary” on it. On the posters, the groups also indicate that teachers have the responsibility to lead by example and stay informed about current environmental issues. There are still examples of environmentally responsible

behavior but there is a different tone to it within the second round of posters; a tone of action. Pictures of these posters can be found in the Appendix V.

Pre/ Post Workshop Questionnaires

The pre and post workshop questionnaires revealed a change in comfort level and expectation of implementation of the Maryland Environmental standards among the participants. The first question on both of the questionnaires was "*How comfortable are you with the Maryland Environmental Literacy Standards?*" The options were are follows:

a. ***Very comfortable***: I have never heard of them before today and don't know anything about them.
b. ***Uncomfortable***: I have heard of them but know very little about them.
c. ***Somewhat comfortable***: I have heard of them before and am familiar with at least one standard.
d. ***Comfortable***: I have heard of them before and am familiar with a few of the standards.
e. ***Very comfortable***: I am familiar with all seven standards and understand them well.

On the pre- workshop questionnaires, 50% (6) of the participants reported feeling ***very uncomfortable*** with the standards, 33% (4) reported feeling ***uncomfortable***, and 17% (2) reported feeling ***somewhat comfortable*** with the standards. The next question asked them to predict, based on their reported comfort level, whether they would expect to incorporate the standards into their internship classroom. The options were as follows:

a. Definitely not
b. Probably not
c. I'm not sure
d. Probably
e. Definitely

The majority of the participants reported unclear or negative expectations for implementation. 17% (2) of participants reported that they would probably not

incorporate the standards into their classrooms, 58% (7) reported that they were not sure, 8% (1) said probably, 17% (2) reported that they definitely would.

When asked to explain their reported comfort levels and implementation intentions, various themes arose. The majority of the participants explained that their comfort level stemmed from their lack of knowledge of the standards. 67% (8) of participants reported their lack of knowledge as a perceived barrier.

Mary[1]: "Since I don't know the standards, it would be very difficult to incorporate them into my classroom so I probably wouldn't."*
Susan: "I don't know enough about it to implement, at least in the correct way."*

Many times, when a participant reported a lack in knowledge as a perceived barrier, the comment was accompanied by a statement demonstrating a willingness to learn (4 participants, 33%).

Tracey: "I don't know a lot about them right now but would hope to learn ways to incorporate them in instruction…"*

Other reported barriers include being unprepared to teach a new set of standards (2 participants, 17%), lack of support from the mentor teacher or flexibility to teach to a new set of standards in their mentor teacher's classroom (2 participants, 17%).

The post-workshop questionnaire results indicated there were no longer any participants who indicated that they were ***very uncomfortable*** or ***uncomfortable*** with the standards. Instead, 8% (1) of participants reported feeling somewhat comfortable, 83% (10) reported feeling ***comfortable,*** and 8% (1) reported feeling ***very comfortable***. In terms of their incorporation intentions, zero participants reported being unsure about whether they would incorporate the standards into their classrooms: 67% (8) reported that they

[1] * indicates pseudonym

would probably incorporate the standards and 33% (4) said they definitely would. Out of the eight participants who reported “probably”, four reported that their hesitation was still due to the perceived barrier of their mentors’ flexibility and encouragement to incorporate a new set of standards into the classroom.

The questionnaires also revealed other helpful information about the participants’ thinking about environmental issues and the workshop design. On the pre- workshop questionnaire, they were asked which environmental issues they were already passionate about, below is a list of the environmental issues they cited:

- Deforestation
- Water loss
- Re-Using materials
- Eating locally
- Waste reduction
- Ocean and Chesapeake Bay wildlife
- Effect of fossil fuels on the environment
- Recycling
- Alternative energy resources

The post- workshop questionnaire also asked the participants to comment on whether the workshop helped them feel more prepared to incorporate the standards and environmental issues into their future classrooms. 100% of the participants reported “yes” to this prompt. The participants most frequently reported that these feelings of preparedness came from going through the standards in detail, having activities and lessons modeled for them, working collaboratively to create their own lessons and learning activities, and gaining more content knowledge about environmental issues that were locally relevant to them.

Interviews

To assess how reported perceived readiness and incorporation intentions translated to actual implementation of the standards into the participants' internship classrooms, I interviewed in December, 2015 three of the PD participants who agreed to participate in the interview. That was three months post workshop toward the very end of their senior level science methods course when they were completing final coursework for their methods courses. The interviewees were not selected to represent the sample, but I believed they had potential to enhance my data set by adding first hand perspectives. As a graduate of the same teacher education program two years earlier, I interpret the small response rate to my invitation to be interviewed their feeling of a lack of time at the end of the semester to add yet another commitment.

The interviews revealed to me that none of the three participants had incorporated the Maryland Environmental Literacy Standards into their classrooms directly. However, two of the participants referred back to the standards at some point within the semester in an attempt to incorporate them while the third participant had not interacted with the standards at any level since the workshop.

All three of the participants attributed their lack of incorporation to common barriers: time constraints in classroom teaching and an inflexible elementary school science education curriculum. During the first semester of their internship, the participants are only in the classroom for two days a week. Their role within the classroom within the first semester is also less dominant than it is during the second semester. For the first few months they use their time to get a feel for a classroom setting, get to know the kids, and observe their mentor teacher. In their interviews, each of the

participants reported that they were unable to incorporate the standards in the classroom to an extent they desired. They attributed this situation to not having enough time to teach science to their students. During this first semester they were also taking five methods courses and an additional classroom management course. They faced a major time constraint in planning how to incorporate environmental education lessons in their field placement classes. They expressed that they felt they did not have time to explore using a new set of standards within their classroom because of the pressures of their school workload.

> *I think I hadn't realized when I left the workshop, all the other factors that go into teaching and I hadn't really been in a classroom yet… so I think I thought, 'oh yeah I can do this!' … But there is a lot more to it than just doing it…This semester I am only there two days a week and there are a lot of other course requirements pressuring me to get those done versus having my own classroom and being able to implement them… next semester that may change.- Sarah**

Each of the participants reported feeling like it was not the appropriate time to try to incorporate a new set of standards into their classrooms, because they were still on their mentor teachers' schedule. I asked them whether they had discussed the standards with their teachers as a way to gauge whether their mentor teachers were in fact a barrier to their incorporation. Two of the participants had not talked about the standards with their mentor teachers, and one had only mentioned that she had participated in a summer workshop about the standards. However, none of the participants seemed to think that their mentor teacher would be a barrier to them during their attempts to incorporate the standards into their classrooms during the next semester.

> *Next semester she will be incredibly open to incorporating the standards. She has been supportive with the lessons I have created so far This semester we are doing more her thing, doesn't make sense to do my thing for just 2 days a week… she is really into the environmental stuff, she has recycling posters in her room and*

*stuff. – Sarah**

*I don't think my teacher is [a barrier]. She is very open to different things."- Mary**

*I told her about I went to a workshop at the beginning but then it never came back up but I think only because she is very busy." –Lisa**

Finally, each of the participants reported the curriculum as a perceived barrier. Sarah cited the curriculum as a barrier, not only because of her lack of access to it, but also because she was unable to see how the existing curriculum aligns with the Maryland Environmental Literacy Standards.

*It is hard to connect some of the curriculum things with the environmental literacy standards because they don't always seem to mesh. The science curriculum standard they are working on now is identifying rocks and I guess I find that I can't… it is hard for me to think how that would fit into an environmental lesson. So there is a conflict between having to teach those things and wanting to teach other things.–Sarah**

The other two participants interviewed also felt that the current curriculum was inflexible, inaccessible or hard to connect to the Maryland Environmental Literacy Standards.

*The curriculum for science was spotty for me because my school is in between curriculums right now, they have a textbook but don't use it. Trying to find what they want to use is tricky. –Lisa**

*Everything is so laid out. Trying to stray from it and go to something else and look at other things and incorporate that into the science curriculum which has options A, B,C or D. There isn't anything specifically for environmentally literacy. So unless something is planned out and already in the curriculum, it is hard to find the time to add something in. It is very regimented. –Mary**

Though these participants did not directly plan a lesson around the Maryland Environmental Literacy Standards, they each did recognize that certain lessons that occurred in their classrooms related to the standards. Sarah commented that a lesson on

the water cycle, produced by her teacher, could have connected to the standards while both Mary and Lisa noted that recycling lessons that occurred in their classrooms tied to the standards as well. It is important to note though that only one of the participants mentioned that the standards could be used interdisciplinarily within their classrooms.

> *I still have the sheet I can refer to when I start taking over the science block. We only have science block twice a week for about an hour but a lot of it can be overlapped into other (subjects).-Sarah**

Besides this one mention of a possible across the curriculum application of the environmental literacy standards, the participants continued to talk about these standards within the confines of the subject of science. Because of this, I believe there is an inferred barrier is an underdeveloped understanding of how to incorporate the standards across other subjects. This is an issue that should be evaluated more closely, and appropriate workshop design changes should be made to help enhance this skill. A copy of the interview questions is located in the Appendix VIII.

Interpretation of Data/ Analysis

One of the primary goals of this workshop was to expose the participants to the Maryland environmental literacy standards and locally relevant environmental issues. Research by Ball, Thames, and Phelps (2008) has indicated that providing teachers with content knowledge, allows them to feel more confident and comfortable with implementing topics within their classrooms. Through a two-day workshop platform, we were able to provide the participants with knowledge of Chesapeake Bay Watershed water and air quality environmental issues, content knowledge pertaining to the Maryland Environmental Literacy Standards, and model classroom instruction and practice revolving these topics. It is evident from workshop artifacts such as pre and post

workshop questionnaires as well as the environmental literacy interpretation posters, that the participants' comfort levels with the MD Environmental Literacy Standards was successfully and significantly increased.

The pre and post workshop questionnaires provide the best evidence for a positive change in the participants' preconceived readiness to incorporate the standards and environmental issue into their classrooms. While at the beginning of the workshop, 83% (10) of the participants reported feeling either ***very uncomfortable*** or ***uncomfortable*** with the standards, by the end of the two days, 91% (11) of the participants reported either feeling ***comfortable*** or ***very comfortable*** with the standards. This change in attitude towards the standards was also reflected in the change of reported implementation intention. While at the beginning of the workshop, 75% (9) of the participants either had no intention or were very unsure of their intention to implement the standards into their internship classroom, by the end of the two days, 100% (12) of the participants reported that they would either probably or definitely implement the standards. The participants self reported this change and most frequently attributed it to (within the second question of the questionnaire: "*If your comfort level is now different from when you first arrived at the workshop please explain what experiences in the workshop have changed it…*") going through the standards, interacting with the standards in multiple ways, working collaboratively with other participants to create learning activities based on the standards, and gaining content knowledge about locally relevant environmental issues. By looking at the environmental literacy interpretation posters, it can also be inferred that their new comfort levels can be attributed to a stronger identification with being an environmentally literate educator. Their description/ drawings of environmental responsible behavior and

a tone of action indicate that they are making positive strides towards possessing "the knowledge, intellectual skills, attitudes, experiences, and motivation to make and act upon responsible environmental decisions as individuals and as members of their community (Maryland Partnership for Children in Nature Report and Recommendations to Governor O'Malley, p.12)."

Though the workshop succeeded in increasing the participants' comfort levels and perceived readiness to incorporate the standards into their classrooms, a gap was observed between perceived readiness and actual implementation during a subsequent semester in duration field placement in an elementary public school classroom. I base this statement on interpretation based on a limited number of interviews conducted four months after the workshop. Though each of the three participants interviewed had indicated an increase in their comfort level to that of "comfortable" and also expressed an eagerness to incorporate the standards into their classrooms, none of them had actually done so within their first semester of student teaching. All three contributed this to two perceived barriers: lack of time and an inflexible curriculum. This has important potential implications for pre-service professional development, if the pattern of responses would pertain to the remainder of the summer participants who did not agree to be interviewed. Though the workshop was beneficial in many ways, it apparently was not successful for preparing the three participants who were interviewed to see how the standards and environmental issues could be incorporated into the classroom when faced with time constraints and a previously established classroom curriculum. When the participants spoke of the "inflexible curriculum" they still referred primarily of the science

curriculum. This suggested to me that they were still thinking of the standards as strictly science oriented instead of interdisciplinary.

To address this potential gap of understanding, I believe that there are potential changes that could be made for future pre-service professional development programs based on the topic of the Maryland Environmental Literacy Standards and environmental issues. First, two days tends to be a reasonable amount of time for a workshop of this capacity because it can be done at the convenience of the participants over a weekend. However, it may be helpful to have the participants work on online modules before the professional development workshop to gain content knowledge as a way to promote a stronger focus on interdisciplinary work and collaborative lesson plan creation during the in person session. Second, we chose to hold this workshop during the summer before the participants had begun a significant placement in an elementary school classroom. It might be beneficial to conduct this workshop after their first semester of their year long school placement. This change of timing for the workshop would allow them to have a greater understanding of the barriers they will face in trying to implement these standards. These barriers could then be presented and tackled as a group during the in-person session. This way, the facilitators of the workshop would have a better understanding of these barriers and be able to provide specific assistance in overcoming them. However, a major challenge to this change of timing for the workshop would be time of the year for the mid-year PD. That is, it would be winter and outdoor experiences such as the stream exploration would be difficult to conduct. Finally, if the participants are all from the same area or county, there should be a strong focus on local and state standards and how they connect with the Maryland Environmental Literacy Standards.

Conclusion

The Maryland Environmental Literacy Standards are an important component in the effort to help Maryland students become environmentally literate citizens who will have the skills and knowledge to provide solutions for pressing environmental issues. Maryland students cannot hope to become environmentally literate however, if their teachers are not environmentally literate themselves or if they are ill equipped to implement these standards into their classroom curriculum and practices. The empirical findings from this investigation suggest that a two-day collaborative workshop that provides content knowledge and exposure to the standards can raise meaningfully pre-service teachers' level of comfort with the standards. This is a positive step towards ensuring that these particular pre-service teachers will feel confident in their ability to incorporate these standards into their classrooms for years to come. However, the gap between intent to implement and actual implementation reported by a small subset of the participants in this study demonstrates the need for additional research and more work to be done to ensure that the future workshops and other professional development experiences based on the Maryland Environmental Literacy Standards will benefit Maryland elementary students.

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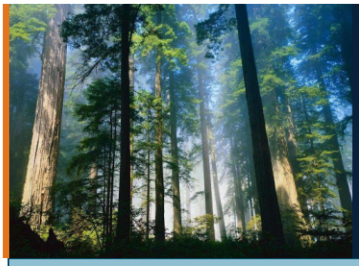
Appendix I- Recruitment Flyer



2014 Teaching for Environmental Literacy Workshop!

Do you desire to improve the lives of your students and the world through education?

Are you interested in the newest, most cutting edge techniques in science education?

Sign up for the voluntary 2014 Teaching for Environmental Literacy Workshop!

Benefits:

1. **HAVE FUN** and collaborate with peers interested in teaching about sustainability and the environment.
2. Gain knowledge and skills that will make you a competitive candidate in future top teaching positions.
3. Feel more prepared to tackle science lessons in your yearlong teaching internship.
4. Become proficient in the 8 MD environmental literacy standards.
5. Produce materials and resources to use within your classroom!

Participants will earn a ***Certificate of Proficiency in Maryland Environmental Literacy Standards!***

*Especially welcome are UMD Elementary Teacher Education Majors entering the 2014 Fall Semester Methods Block: Dates are PDS coordinator approved!

When:
August 21st & 22nd
(approved by PDS coordinators)

Where: University of Maryland

Cost: FREE! We even provide lunch!

How to apply: Visit http://ter.ps/ELW to fill out a short application!

Application deadline: May 10th

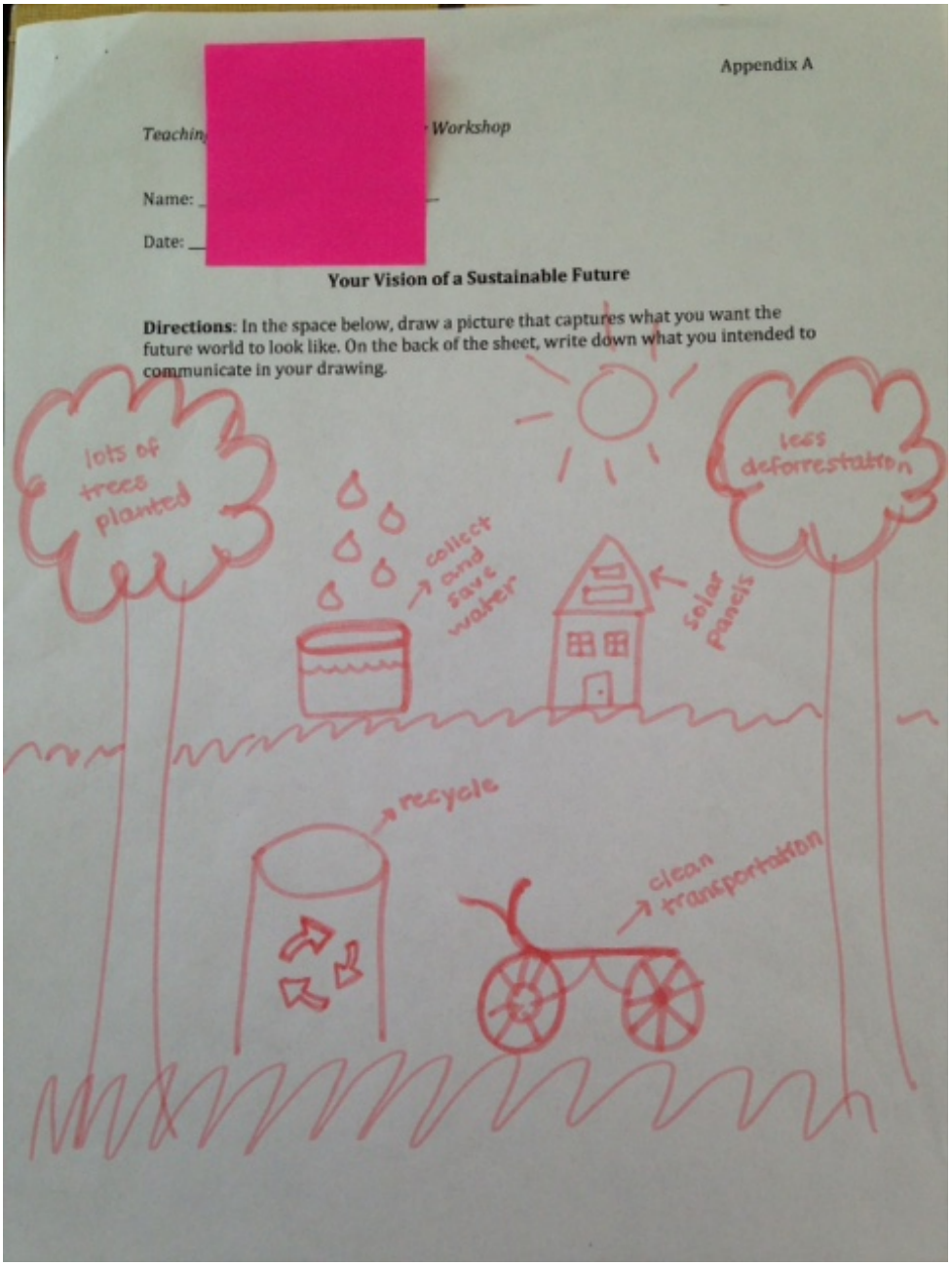
LIMITED SPOTS AVAILABLE!

Questions? Email
katywellington91@gmail.com

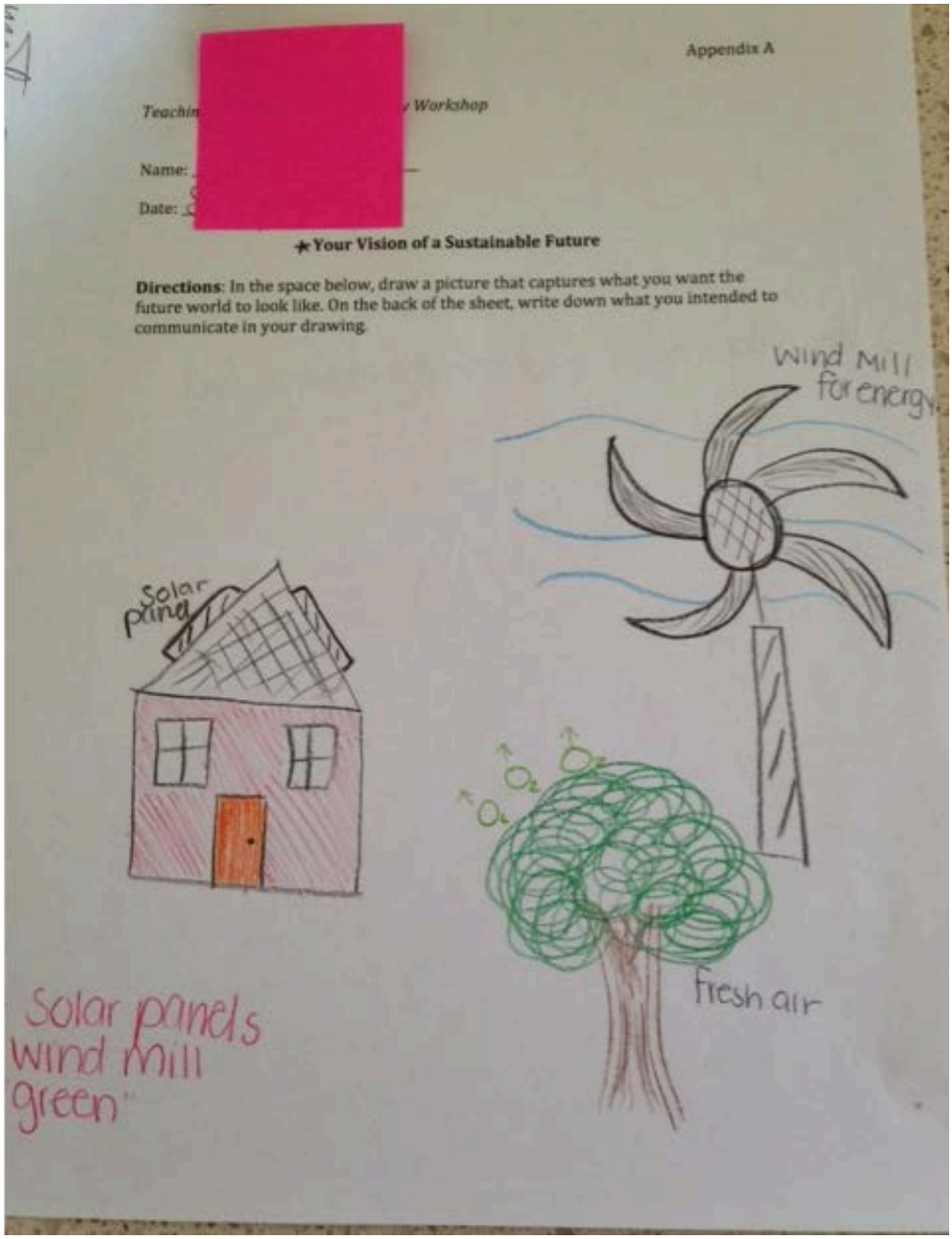
COLLEGE OF EDUCATION

Appendix II- Visions of a Sustainable Future Drawing Example

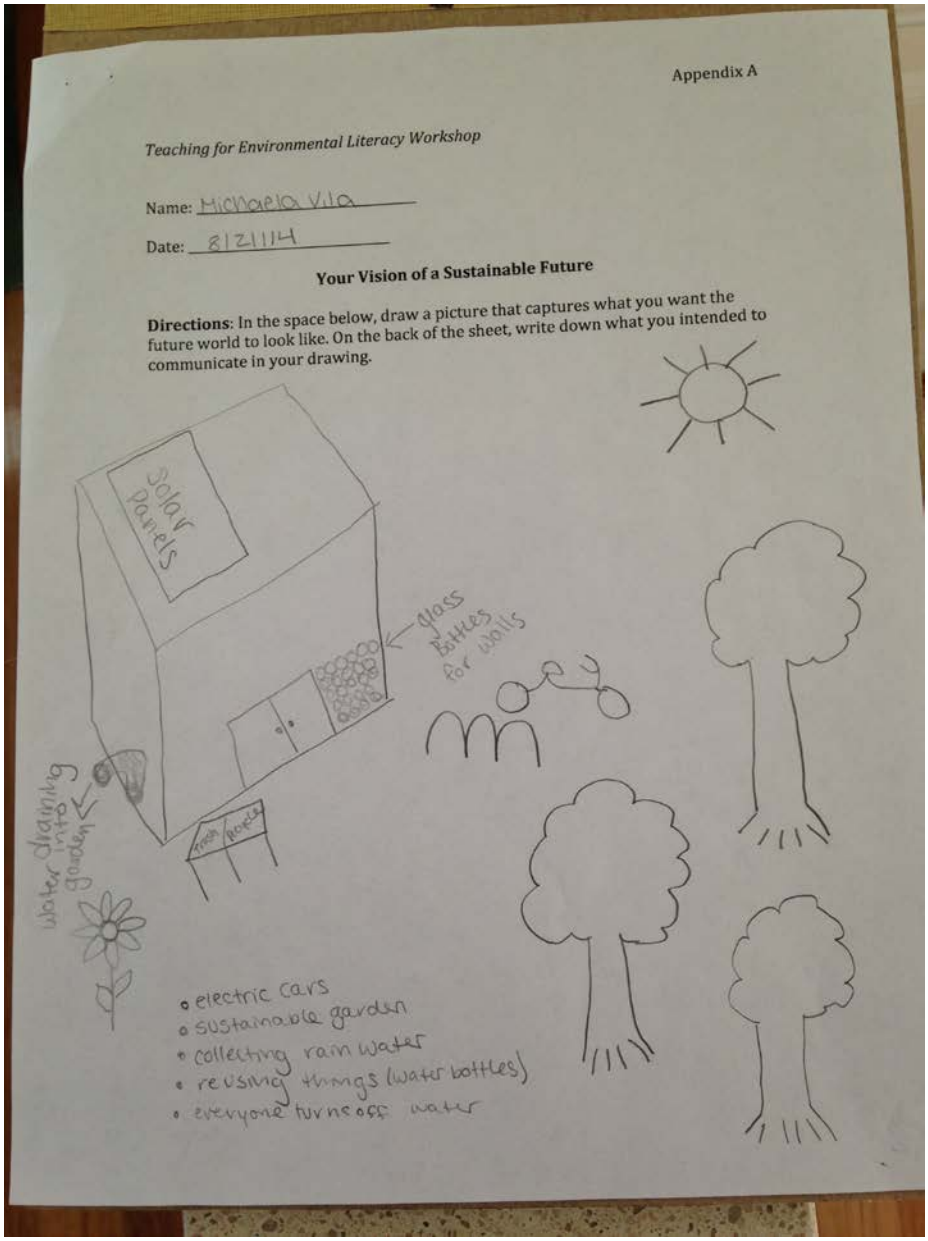
Example 1: Positive depictions of nature



Example 2: Renewable energy/ alternative modes of energy



Example 3: Waste reduction



Appendix A

Teaching for Environmental Literacy Workshop

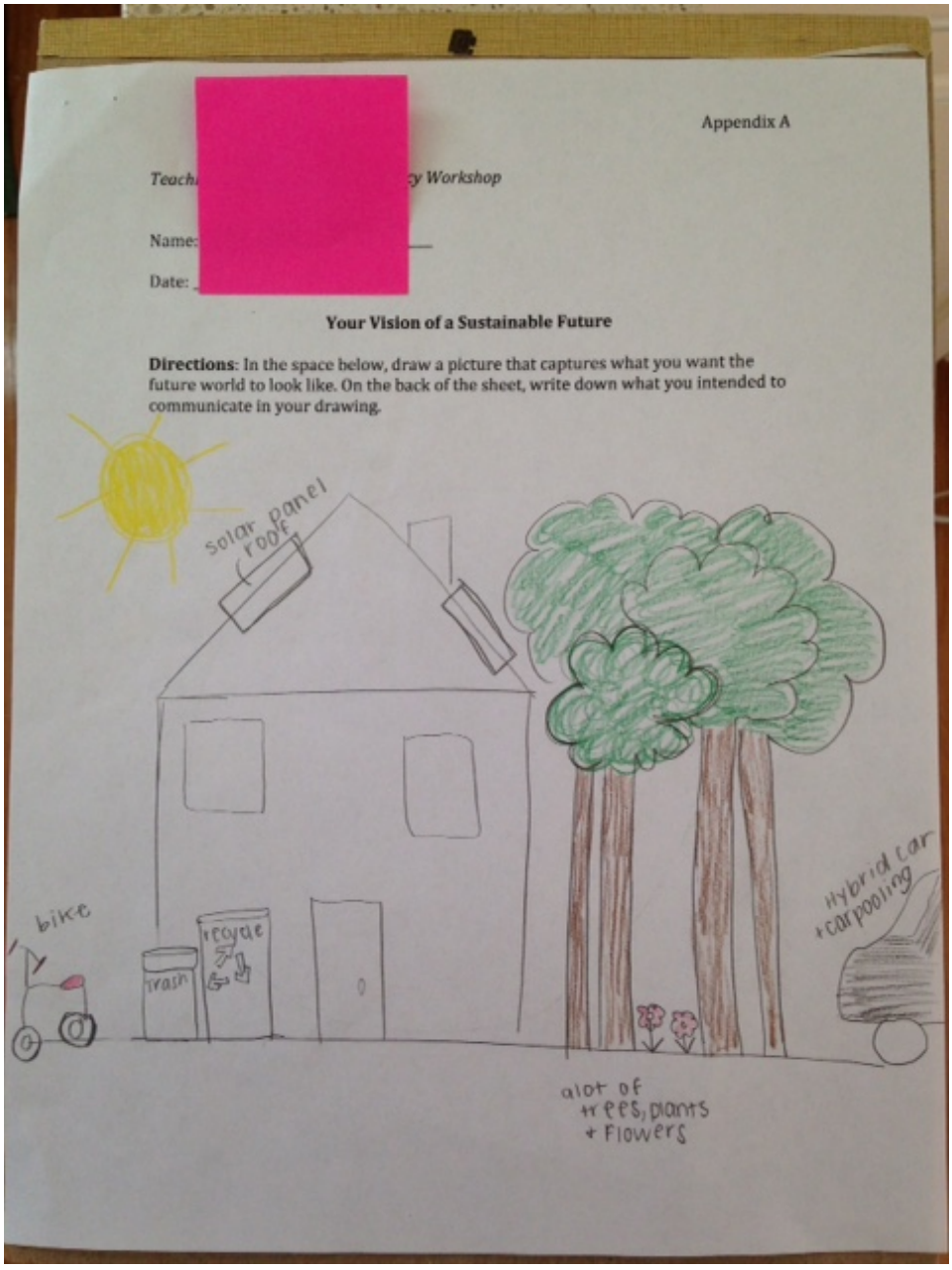
Name: Michaela Vila

Date: 8/21/14

Your Vision of a Sustainable Future

Directions: In the space below, draw a picture that captures what you want the future world to look like. On the back of the sheet, write down what you intended to communicate in your drawing.

Example 4: Cleaner modes of transportation



Appendix III- Pre-Workshop Questionnaire

Pre-Workshop Questionnaire

Name: _____
Date: _____

1. How comfortable are you with the Maryland Environmental Literacy Standards? Circle one.
a. ***Very uncomfortable***: I have never heard of them before today and don't know anything about them.
b. ***Uncomfortable***: I have heard of them before but know very little about them.
c. ***Somewhat comfortable***: I have heard of them before and am familiar with at least one standard.
d. ***Comfortable***: I have heard of them before and am familiar with a few of the standards.
e. ***Very comfortable***: I am familiar with all seven the standards and understand them well.

2. Based on our comfort level with the standards as of right now, would you expect to incorporate any Maryland Environmental Literacy Standards into your classroom during your yearlong internship? Circle one.

a. **Definitely not**
b. **Probably not**
c. **I'm not sure**
d. **Probably**
e. **Definitely**

Please explain your answer:

3. What, if any, environmental issues are you interested in or passionate about? Why?

Appendix IV- Post- Workshop Questionnaire

Post- Workshop Questionnaire

Name: _____
Date: _____

1. Now that you have gone through the *Teaching for Environmental Literacy Workshop*, how comfortable are you with the Maryland Environmental Literacy Standards? Circle one.

a. ***Very uncomfortable***: I have never heard of them before today and don't know anything about them.

b. ***Uncomfortable***: I have heard of them before but know very little about them.

c. ***Somewhat comfortable***: I have heard of them before and am familiar with at least one standard.

d. ***Comfortable***: I have heard of them before and am familiar with a few of the standards.

e. ***Very comfortable***: I am familiar with all seven the standards and understand them well.

2. If your comfort level is now different from when you first arrived at the workshop please explain what experiences in the workshop have changed it.

3. Based on our comfort level with the standards as of right now, would you expect to incorporate any Maryland Environmental Literacy Standards into your classroom during your yearlong internship? Circle one.

a. **Definitely not**
b. **Probably not**
c. **I'm not sure**
d. **Probably**
e. **Definitely**

Please explain your response:

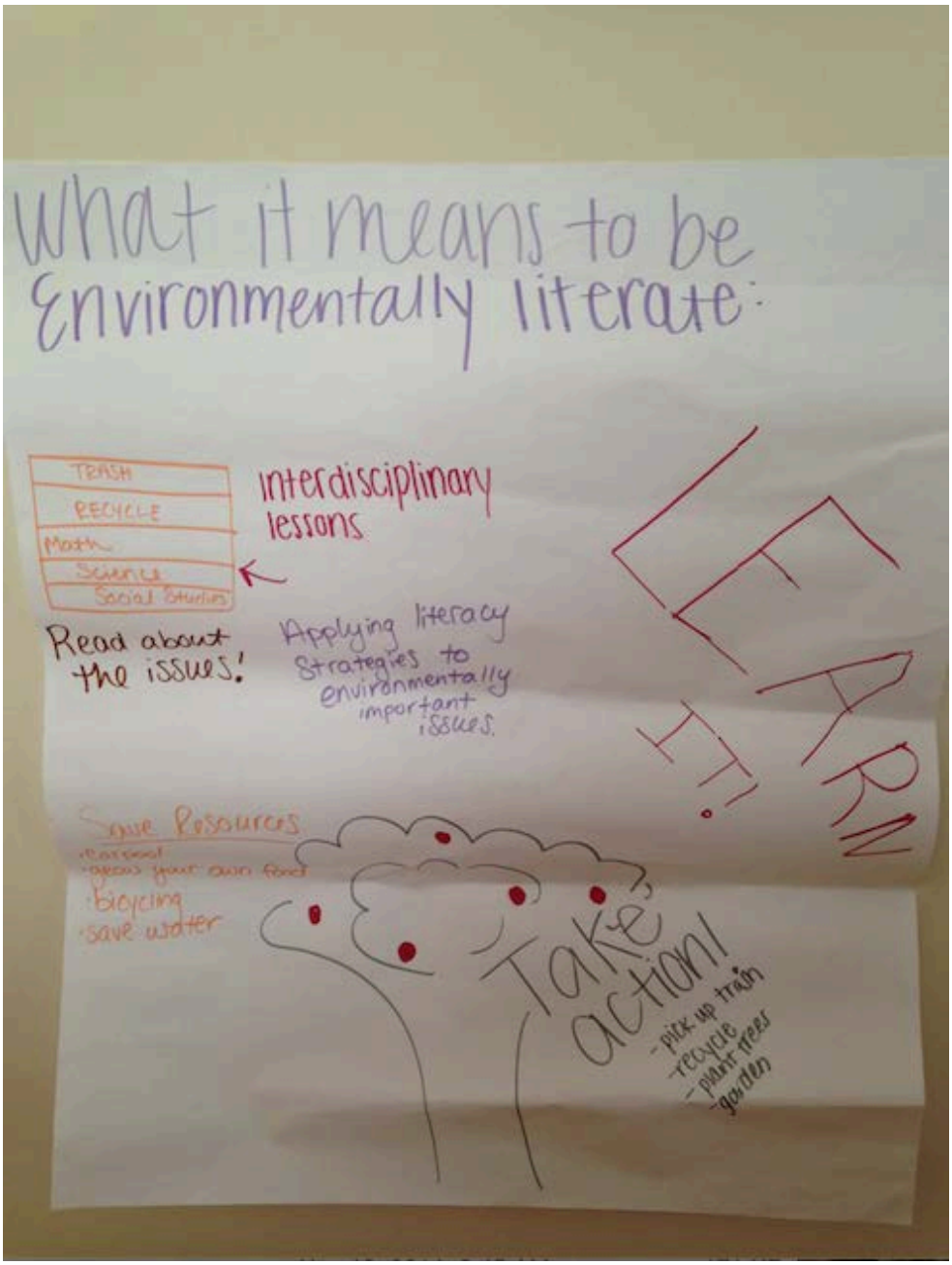
4. Which standards do you think you are most likely to incorporate into your classroom during your yearlong internship? Why?
5. Did this workshop help you feel more prepared to incorporate the Maryland Environmental Literacy Standards into your classroom? Please explain.

5. Did this workshop help you feel more prepared to incorporate environmental issues into your classroom? Please explain.

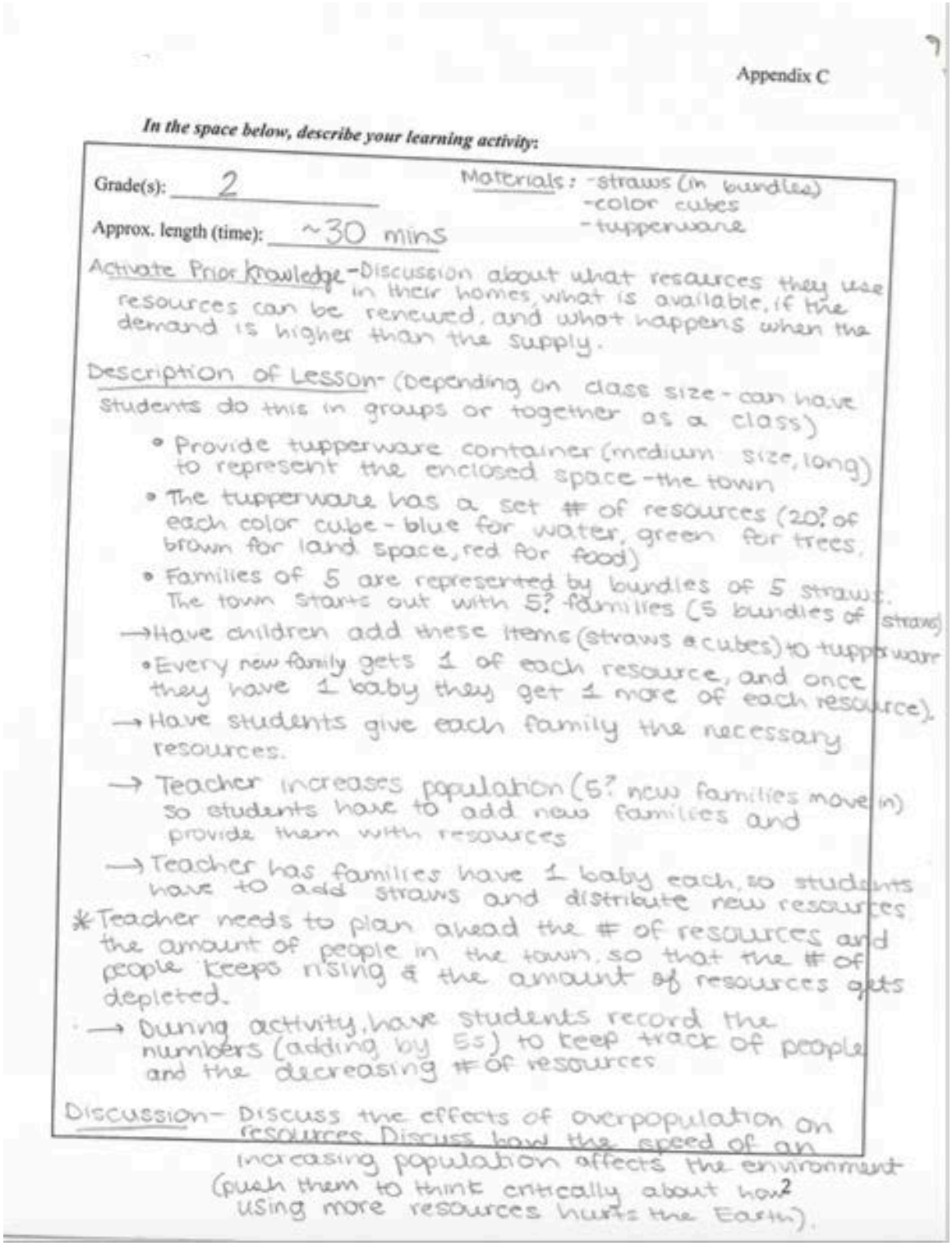
Appendix V- Examples of Environmental Literacy Interpretation Posters

Day 1 Poster

Day 2 Poster


What it means to be Environmentally literate:
TRASH
RECYCLE
Math
Science
Social Studies
interdisciplinary lessons
Read about the issues!
Applying literacy strategies to environmentally important issues.
LEARN IT!
Save Resources
·bicycling
·save water
Take action!
- pick up trash
-recycle
- plant trees
-garden

Appendix VI- Example of a Learning Activity (created collaboratively among participants)



Appendix C

In the space below, describe your learning activity:

Grade(s): 2

Approx. length (time): ~30 mins

Materials: -straws (in bundles)
-color cubes
-tupperware

Activate Prior Knowledge - Discussion about what resources they use in their homes, what is available, if the resources can be renewed, and what happens when the demand is higher than the supply.

Description of Lesson - (Depending on class size - can have students do this in groups or together as a class)

- Provide tupperware container (medium size, long) to represent the enclosed space - the town
- The tupperware has a set # of resources (20? of each color cube - blue for water, green for trees, brown for land space, red for food)
- Families of 5 are represented by bundles of 5 straws. The town starts out with 5? families (5 bundles of straws)

→ Have children add these items (straws & cubes) to tupperware

- Every new family gets 1 of each resource, and once they have 1 baby they get 1 more of each resource).

→ Have students give each family the necessary resources.

→ Teacher increases population (5? new families move in) so students have to add new families and provide them with resources

→ Teacher has families have 1 baby each, so students have to add straws and distribute new resources

* Teacher needs to plan ahead the # of resources and the amount of people in the town, so that the # of people keeps rising & the amount of resources gets depleted.

→ During activity, have students record the numbers (adding by 5s) to keep track of people and the decreasing # of resources

Discussion - Discuss the effects of overpopulation on resources. Discuss how the speed of an increasing population affects the environment (push them to think critically about how using more resources hurts the Earth).

Appendix C

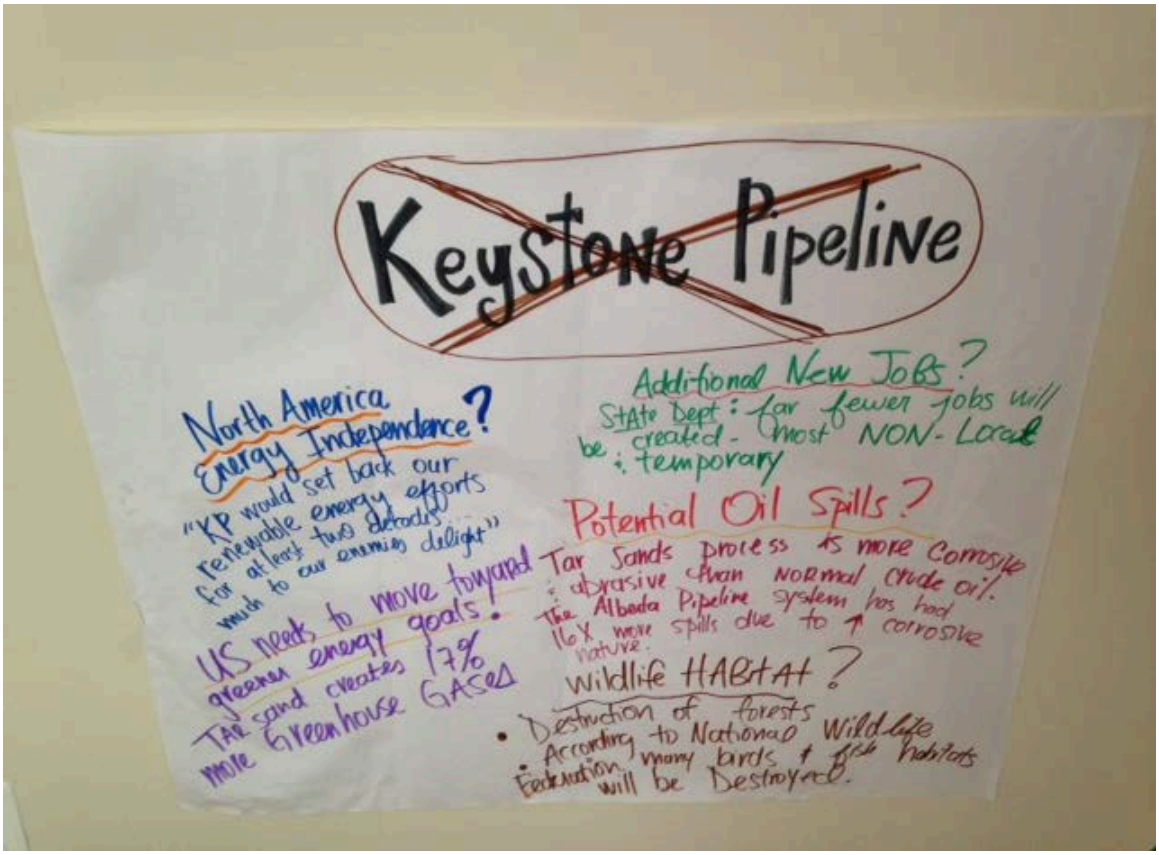
Which environmental literacy standard are you addressing within your learning activity? Explain.

Standard 4- Populations, Communities & Ecosystems
Topic B- Population Dynamics
Indicator 1- Analyze the growth or decline of populations & identify a variety of reasonable factors
(We chose the topic of Human Overpopulation)

Which subject are you addressing within your learning activity? Explain.

Mathematics - students will learn how to add in steady increments of 5. They will also develop the early building blocks of division by distributing the resources to each family.

Appendix VII- Keystone Pipeline Debate Poster Example



Appendix VIII- Interview Questions

Interview Questions: Up to 4 months post- workshop

Goal: *Gain insight as to whether participants have used new knowledge of Maryland Environmental Literacy Standards to incorporate lessons regarding environmental issues into their classroom curriculum. Interview will take approximately 30-40 minutes.*

1. Have you referred back to the Maryland Environmental Literacy Standards since the workshop?

2. On your final survey you reported your comfort level with the standards as being _____. Has your comfort level with the standards changed at all since the workshop?

3. Have you used any of the Maryland Environmental Literacy Standards to create a lesson plan for your students? If yes, please describe the lesson.

4. What environmental issues, if any, have you discussed in your classroom over the past few months? Was what you discussed influenced by your workshop?

5. Are you planning to use the Maryland Environmental Literacy Standards in the second half of your internship? If so, describe.

6. Are you planning to discuss any environmental issues in your classroom during the second half of your internship?

7. If one of the days of the 2-days of the workshop was turned into an online experience what topics do you believe would be acceptable to learn in that delivery mode?